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भाग 2 तंत्र डिजाइन

अनुभाग 4 विद्युत और विद्युत-द्रवचालित स्टिरिंग गियर

Indian Standard

ELECTRICAL INSTALLATIONS IN SHIPS — SPECIFICATION

PART 2 SYSTEM DESIGN

Section 4 Electric and Electrohydraulic Steering Gear

UDC 629·12·066 : 621·316·174 : 629·12·014·5

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

November 1993 **Price Group 2**

Electrical Equipment and Installations in Ships and Offshore Structures Sectional Committee, ET 26

FOREWORD

This Indian Standard (Part 2/Sec 4) was adopted by the Bureau of Indian Standards, after the draft finalized by Electrical Equipment and Installations in Ships and Offshore Structures Sectional Committee had been approved by the Electrotechnical Division Council.

This standard (Part 2/Sec 4) is one among the series of the Indian Standards on electrical installations in ships. This series will have the following parts:

Part 1 General,

Part 2 System design,

Part 3 Equipment,

Part 4 Installation and test of completed installations, and

Part 5 Special features.

In preparing this standard, assistance has been taken from the IEC Publication 92-204 (1987) 'System design — Electric and electrohydraulic steering gear — specification', issued by the International Electrotechnical Commission.

This part of the standard shall be read in conjunction with IS 10242 (Part 2/Sec 1) : 1982 'Specification for electrical installations in ships: Part 2 System design, Section 1 General' IS 10242 (Part 2/Sec 2) : 1983 'Specification for electrical installations in ships: Part 2 System design, Section 2 Protection', and other parts mentioned above.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

ELECTRICAL INSTALLATIONS IN SHIPS — SPECIFICATION

PART 2 SYSTEM DESIGN

Section 4 Electric and Electrohydraulic Steering Gear

1 SCOPE

1.1 This standard (Part 2/Sec 4) is applicable to the main features of electric and electrohydraulic steering gear for use in ships.

2 REFERENCES

2.1 IS 4722 : 1968 'Specification for rotating electrical machines' is a necessary adjunct to this standard.

SECTION 4A — DEFINITION

3 DEFINITIONS

3.0 For the purpose of this standard, the following definitions shall apply.

3.1 Main Steering Gear

The machinery, rudder actuators, steering gear power units and ancillary equipment and the means of applying torque to the rudder stock (for example tiller or quadrant) necessary for effecting movement of the rudder for the purpose of steering the ship under normal service conditions.

3.2 Auxiliary Steering Gear

The equipment, other than any part of the main steering gear, necessary to steer the ship in the event of failure of the main steering gear but not including the tiller, quadrant or components serving the same purpose.

3.3 Electric Steering Gear

A power operated steering gear where an electric motor applies torque to the rudder stock through mechanical means only.

3.4 Electrohydraulic Steering Gear

A power operated steering gear where a hydraulic pump driven by an electric motor, applies torque to the rudder stock through hydraulic and mechanical means.

3.5 Steering Gear Power Unit

a) In the case of electric steering gear, an electric motor and its associated electrical equipment.

b) In the case of electrohydraulic steering gear, an electric motor and its associated electrical equipment and connected pump.

3.6 Steering Gear Control System

The equipment by which orders are transmitted from the navigating bridge to the steering gear power units. Steering gear control systems comprise transmitters, receivers, hydraulic control pumps and their associated motors, motor controllers, piping and cables, etc.

SECTION 4B — DESIGN ASPECTS

4 POWER OPERATED STEERING GEAR

4.1 Electric or electrohydraulic steering gear may be used for the power operated main and auxiliary steering gear required by *SOLAS Rules, 1974* and subsequent amendments.

4.2 The electrical systems of the main steering gear and auxiliary steering gear shall be so arranged that any failure in one of the steering gears will not render inoperative the electrical systems of the other steering gear.

When an auxiliary steering gear is not required by *SOLAS, 1974* and the main steering gear comprises two or more power units, the electrical system for each power unit shall be so arranged that the failure of one of them will not render the other units inoperative.

SECTION 4C — MOTORS AND ASSOCIATED CONTROL GEAR

5 MOTORS

5.1 To determine the required characteristics of the electric motors for power units, the breakaway and maximum working torque of the steering gear under all operating conditions shall be considered. The ratio of pull-out torque to rated torque shall be at least 1·6.

5.2 Motors for steering gear power units may be rated for intermittent power demand.

The rating shall be determined on the basis of the steering gear characteristics of the subject ship.

In any case the rating should be at least:

For motors of electric steering gear power units:

S3 — 40 percent according to IS 4722 : 1968.

For motors of electrohydraulic steering gear power units and for converters:

S6 — 25 percent according to IS 4722 : 1968.

6 MOTOR STARTERS

Each electric motor of a main or auxiliary steering gear power unit shall be provided with its own separate motor starter gear located within the steering gear compartment. Alternatively it is permitted to locate the motor starter gear in the supplying main switchboard or main engine control room, and in the supplying emergency switchboard or emergency switchboard room.

SECTION 4D — CIRCUIT DESIGN

7 POWER CIRCUITS SUPPLY

7.1 Each electric of electrohydraulic steering gear comprising one or more power units shall, except as otherwise permitted by *SOLAS Rules, 1974* and subsequent amendments, be served by at least two exclusive circuits, fed directly from the main switchboard, however one of the circuits may be supplied through the emergency switchboard.

7.2 An auxiliary electric or electrohydraulic steering gear associated with a main electric or electrohydraulic steering gear may be connected to one of the circuits supplying the main steering gear.

7.3 The circuits supplying an electric or electrohydraulic steering gear shall have adequate rating for supplying all electric motors and devices which can be simultaneously connected to them and may be required to operate simultaneously.

7.4 For certain ships specified in *SOLAS 1974*, an alternative power supply from the emergency source of electrical power or from an independent source of power located within the steering gear compartment, is required.

This power supply shall be activated automatically, within 45 s, in the event of power failure of the main source(s) of electrical power and shall meet the requirements of *SOLAS Rules, 1974* and subsequent amendments.

8 SUPPLY OF CONTROL CIRCUITS AND CONTROL SYSTEMS

8.1 Each control for starting and stopping of motors for power units shall be served by its own control circuit supplied from its respective power circuit.

8.2 Any electrical main and auxiliary steering gear control system shall be served by its own separate circuit supplied from a steering gear power circuit from a point within the steering gear compartment, or directly from switchboard busbars supplying that steering gear power circuit at a point on the switchboard adjacent to the supply to the steering gear power circuit.

9 CIRCUIT PROTECTION

9.1 Short-circuit protection shall be provided for each control circuit and each power circuit of electric or electrohydraulic main and auxiliary steering gear.

9.2 No protection other than short-circuit protection shall be provided for steering gear control system supply circuits.

9.3 Protection against excess current, if provided for power circuits, shall be for not less than twice the full load current of the motor or circuit so protected, and shall be arranged to permit the passage of the appropriate starting currents.

SECTION 4E — CONTROLS AND INDICATIONS

10 STARTING AND STOPPING OF MOTORS FOR STEERING GEAR POWER UNITS

10.1 Motors for power units shall be capable of being started and stopped from a position on the navigating bridge and from a point within the steering gear compartment.

Means shall be provided at the position of the motor starters for isolating any remote controlled starting and stopping devices.

10.2 Main and auxiliary steering gear power units shall be arranged to restart automatically when power is restored after a power failure.

11 STEERING GEAR CONTROL SYSTEMS

11.1 For the main steering gear, control for the steering gear shall be provided both on the navigating bridge and in the steering gear compartment.

11.2 For the power operated auxiliary steering gear, control for steering gear shall be provided in the steering gear compartment and it shall also be operable from the navigating bridge and shall be independent of the control system for the main steering gear.

11.3 When, in accordance with *SOLAS Rules, 1974* and subsequent amendments, an auxiliary steering gear is not installed and the main steering gear comprises two or more identical power units, two independent control systems shall be provided, both operable from the navigating bridge and the steering gear compartment.

This does not require duplication of the steering wheel or steering lever.

Where the control system includes a hydraulic telemotor, a second independent control system need not be fitted, except where specified in *SOLAS Rules, 1974* and subsequent amendments.

11.4 The steering gear control system provided in accordance with **11.1**, **11.2** and **11.3** shall be capable of being brought into operation from a position on the navigating bridge.

11.5 Means shall be provided in the steering gear compartment for isolating any steering gear control system operable from the navigating bridge from the steering gear it serves.

12 ALARMS AND INDICATIONS

12.1 Means for indicating that the motors of electric and electrohydraulic steering gear are running shall be installed on the navigating bridge and at a suitable main machinery control position.

12.2 Overload alarm shall be provided for motors of power units for all main and auxiliary steering gear.

12.3 Where a three-phase power supply is used, an alarm shall be provided that will indicate failure of any one of the supply phases.

12.4 In the event of a power failure to any one of the steering gear power units, an alarm shall be given.

12.5 In the event of power failure of electrical power supply to the control system, an alarm shall be given.

12.6 A low level alarm for each hydraulic fluid reservoir shall be provided to give the earliest practicable indication of hydraulic fluid leakage.

12.7 The alarms required by **12.2** to **12.6** shall be both audible and visual and shall be located as specified in *SOLAS Rules, 1974* and subsequent amendments.

13 RUDDER ANGLE INDICATION

The angular position of the rudder shall be indicated on the navigating bridge and where necessary, it shall be recognizable from all coming positions. The rudder angle indication system shall be independent of the steering gear power and control systems and supplied through the emergency switchboard, or by an alternative independent source of electric power such as that referred to in **7.4**.

NOTE — The angular position of the rudder should be recognizable, in accordance with *SOLAS Rules, 1974* and subsequent amendments in the steering gear compartment. The indication need not be electrical.

SECTION 4F — SEPARATION

14 SEPARATION OF CIRCUITS

Duplicated electric power circuits and their steering gear control systems with their associated components shall be separated as far as practicable.

The corresponding cables shall follow different routes which shall be separated both vertically and horizontally, as far as practicable, throughout their entire length.

SECTION 4G — COMMUNICATION

15 COMMUNICATION BETWEEN NAVIGATING BRIDGE AND STEERING GEAR COMPARTMENT

A means of communication shall be provided between the navigating bridge and the steering gear compartment.

If electrical it shall be fed through the emergency switchboard or it shall be sound powered and it should be housed in an acoustic bridge.

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